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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/428,052	10/27/99	IRINO	K 970901A

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EXAMINER

DIAZ, J

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 03/09/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 09/428,052	Applicant(s) IRINO, KIYOSHI	
	Examiner José R. Díaz	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 6-13 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 6-13 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claims ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☒ All b) ☐ Some * c) ☐ None of the CERTIFIED copies of the priority documents have been:
1. ☐ received.
2. ☐ received in Application No. (Series Code / Serial Number) ____.
3. ☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

- | | |
|---|--|
| 14) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 17) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). ____. |
| 15) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 18) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 16) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>3</u> . | 19) <input type="checkbox"/> Other: _____ |

Art Unit: 2815

DETAILED ACTION

Drawings

➤ The drawings are objected to under 37 CFR 1.83(a) because they fail to show “the ohmic electrodes 17A and 17B and the contact holes” in the figure 5F, as described in the specification in page 11, lines 11-16. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Correction is required.

➤ The drawings are objected to under 37 CFR 1.83(a) because they fail to show “the ohmic electrodes 27A and 27B and the contact holes” in the figure 7F, as described in the specification in pages 14 (lines 34-37) and 15 (lines 1-2). Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Correction is required.

➤ The drawings are objected to because a description of figures 5G and 7G is not included in the detailed description of the invention. Correction is required.

Claim Objections

➤ Claim 9 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 9 provides for the use of “a method as claimed in claim 9”, but, since the claim does not set forth any

Art Unit: 2815

steps involved in the method/process, it is unclear what method/process applicant is intending to encompass.

➤ Claim 10 objected to because of the following informalities:

- The word "asid" should be change to --said--

Appropriate correction is required.

Claim Rejections - 35 USC § 112

➤ The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 6-7 and 10-12 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 6-7 and 10-12 disclose a method in which N atoms are introduced in the substrate/gate oxide film interface by a combination of two processes: thermal annealing in an atmosphere containing N atoms (claim 7) and ion implantation of N⁺ ions (claim 10-12). In Applicant's disclosure (page, lines 5-25), applicant discloses a first embodiment of the invention in which the N atoms are introduced by thermal annealing in an atmosphere containing NO after forming the diffusion regions 11B and 11C by ion implanting of the p-type dopant or n-type dopant. In page 14 (lines 2-12), applicant discloses a second embodiment of the invention in which the N atoms are introduced by ion implantation

Art Unit: 2815

process in which N^+ ions are introduced in the substrate/gate oxide film interface after forming the diffusion regions 21B and 21C. Therefore, applicant fails to teach, disclose, or suggest introducing N atoms in the substrate/gate oxide film interface by the combination of the processes of thermal annealing in an atmosphere containing N atoms and ion implantation of N^+ ions.

- The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

- Claims 8-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- Claim 8 recites the limitation "said atmosphere contains NO" in line 7. There is insufficient antecedent basis for this limitation in the claim.

- Claim 9 recites the limitation "said atmosphere contains N_2O " in line 14. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 2815

➤ Claims 6-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanba (JP 04010547) in view of Yamashita et al. (US Patent No. 5,731,233).

Regarding claims 6, 7-9, and 13, Kanba discloses a method of manufacture a semiconductor device comprising forming a gate oxide film on a silicon substrate which consists of an N-type low-concentration region; growing an impurity-containing polysilicon film on the whole surface; anisotropic etching the polysilicon film and the gate oxide film to form a gate electrode; forming a BSG film by a vapor growth; diffusing a P-type impurity (boron) by performing a nitrogen annealing to form a P-type low-concentration regions; anisotropic etching gate oxide film to form a sidewalls on the side surfaces of the gate electrode; ion implanting a P-type impurity (boron) using the sidewalls as masks to form a P-type high-concentration regions (abstract).

➤ However, Kanba does not teach introducing nitrogen ions (N^+) by ion implantation.

Regarding claims 10-12, Yamashita et al. teach a method of manufacturing a semiconductor device in which after forming an oxide film on a polysilicon layer, nitrogen ions (N^+) are implanted into the oxide film through the surface thereof under the conditions of 30 keV and $4 \times 10^{15} \text{ cm}^{-2}$.

Regarding the difference in temperature, acceleration voltage and implantation dose between the references and the method claimed, it would have been obvious to one of ordinary skill in the art, since it has been held that discovering an optimum value

Art Unit: 2815

of a result effective variable involves only routines skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

➤ Therefore, it would have been obvious to one having ordinary skill in the art at the same time the invention was made to have modified Kanba to include introducing nitrogen ions (N^+) by ion implantation, since such modification would result in a optimized method of doping nitrogen and in a semiconductor device capable of preventive short-circuiting between the gate electrodes and the source/drain regions, as described in columns 13 (lines 33-41) and 32 (lines 50-54) of Yamashita et al.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yamashita et al. (US Patent No. 5,554,871) disclose a MOS transistor capable of improving hot carrier resistance. Hause et al. (US Patent No. 5,861,335) discloses a semiconductor fabrication employing a post-implant anneal within a low temperature and high pressure nitrogen ambient to improve channel and gate oxide reliability. Sekiya (JP 04139882) discloses a thin transistor. Ping (US Patent No. 5,616,519) discloses a non-etch back SOG process for hot aluminum metallization.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R. Díaz whose telephone number is (703) 308-6078. The examiner can normally be reached on 8:00 - 5:00 Monday through Fridays.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mahshid Saadat can be reached on (703) 308-4915. The fax phone

Art Unit: 2815

numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JRD
March 7, 2000


DAVID HARDY
PRIMARY EXAMINER